
A New Species of *Pyrrosia* (Polypodiaceae) from Madagascar

F. Rakotondrainibe

Attachée honoraire au Muséum national d'Histoire naturelle, Département Systématique et Évolution, Case postale 39, 57 rue Cuvier, F-75231 Paris CEDEX 05, France. rakotond@mnhn.fr

P. H. Hovenkamp

Netherlands Centre for Biodiversity Naturalis (section NHN), Leiden University, P.O. Box 9514, 2300 RA Leiden, The Netherlands. hovenkamp@nhn.leidenuniv.nl

ABSTRACT. A new species of *Pyrrosia* Mirb. (Polypodiaceae) with coenosori, which is found in the province Antsiranana in Madagascar, is described as *P. avaratra* Rakotondr. & Hovenkamp, with keys and an illustration.

Key words: Coenosori, IUCN Red List, Madagascar, Polypodiaceae, *Pyrrosia*.

The genus *Pyrrosia* Mirb. consists of 51 species worldwide (Hovenkamp, 1986), although opinions vary strongly on the number of species that should be recognized (Shing & Iwatsuki, 1997). In Madagascar, there are three species, one of which is endemic, *P. niphoboloides* (Baker) M. G. Price. In the Polypodiaceae, the genera *Drymoglossum* C. Presl and *Saxiglossum* Ching have formerly been distinguished, based on the presence of longitudinal coenosori, in many cases accompanied by a pronounced leaf dimorphism. The inclusion of these genera in *Pyrrosia* is supported by molecular data (e.g., Schneider et al., 2004), which show *Drymoglossum* species to be deeply nested inside *Pyrrosia*.

Herein we report a new coenosoroid species of *Pyrrosia* from Madagascar, bringing the total number of species to four, of which two are endemic.

Pyrrosia avaratra Rakotondr. & Hovenkamp, sp. nov. TYPE: Madagascar. Antsiranana: près de Joffreville, dans le Parc National de la Montagne d'Ambre, au campement de Ben Freed, 12°27'S, 49°13'E, 250–500 m, 3–10 Aug. 1993, O Andrianantoanina & B. Rochscoehclher 279 (holotype, MO-04916389; isotypes, G-00236282, P-00697016, TAN). Figure 1.

Haec species *Pyrrosiae rhodesianae* similis, sed ab ea frondibus angustioribus atque soris linearibus longitudinalibus differt.

Rhizome shortly elongated, not grooved ventrally, ca. 1.3 mm thick, phyllopodia ca. 3–12 mm apart, lateral buds situated to 1/3 down the internodia;

rhizome anatomy, with the ground tissue parenchymatous, sclerenchyma sheath absent, sclerenchyma strands absent; vascular strands 7; rhizome scales peltate, 2.8–3.1 × 0.5–0.6 mm; base irregularly dentate; acumen light brown, strongly dentate. Leaves monomorphic, sessile or indistinctly stipitate; stipes to 0.5 cm; lamina, index ± 20:1; widest at or above the middle, 7–20 × 0.5 cm (when dry, but 0.7 cm in fresh state), base gradually narrowed, apex ± narrowly acute; venation indistinct, without secondary veins, 2 complete and 1 incomplete marginal rows of areoles present; included veinlets rare, simple, free, excurrent; hydathodes distinct, mostly marginal, somewhat sunken; lamina ± 0.3 mm thick, anatomy with upper epidermis with distinctly projecting cells with thin walls, hypodermis composed of a single discontinuous layer, palisade and spongy parenchyma distinct, lower epidermis with moderately thickened cell walls; stomata sunken, pericytic; indument on lower lamina surface dimorphic, a dense mat, persistent, light brown; composed of an upper layer with hairs ca. 1 mm diam., with 6 to 11 ± appressed, acicular rays, and a dense lower layer composed of hairs with woolly rays. Sori elongated or linear, longitudinal, forming an interrupted or continuous coenosorus ca. 1 mm wide at ca. halfway between costa and margin; developing simultaneously, when old distinct, just emerging from the indument. Sporangia on stalks to ± 1/2× as long as the capsule, capsule ± 0.4 mm high, with 23 or 24 indurate annulus cells; paraphyses not differentiated; spores 75–80 × 45–50 µm, sparsely granulate to shallowly verrucate.

Distribution and habitat. *Pyrrosia avaratra* is endemic to the north of Madagascar. It is found only on the western slopes of the Montagne d'Ambre (Parc national de la Montagne d'Ambre), south of Antsiranana, and in Binara and Antsahabe, in the protected forest of Loky–Manambato, southwest of Daraina. It was observed as an epiphyte in evergreen or semi-deciduous forest, at 500–1230 m.

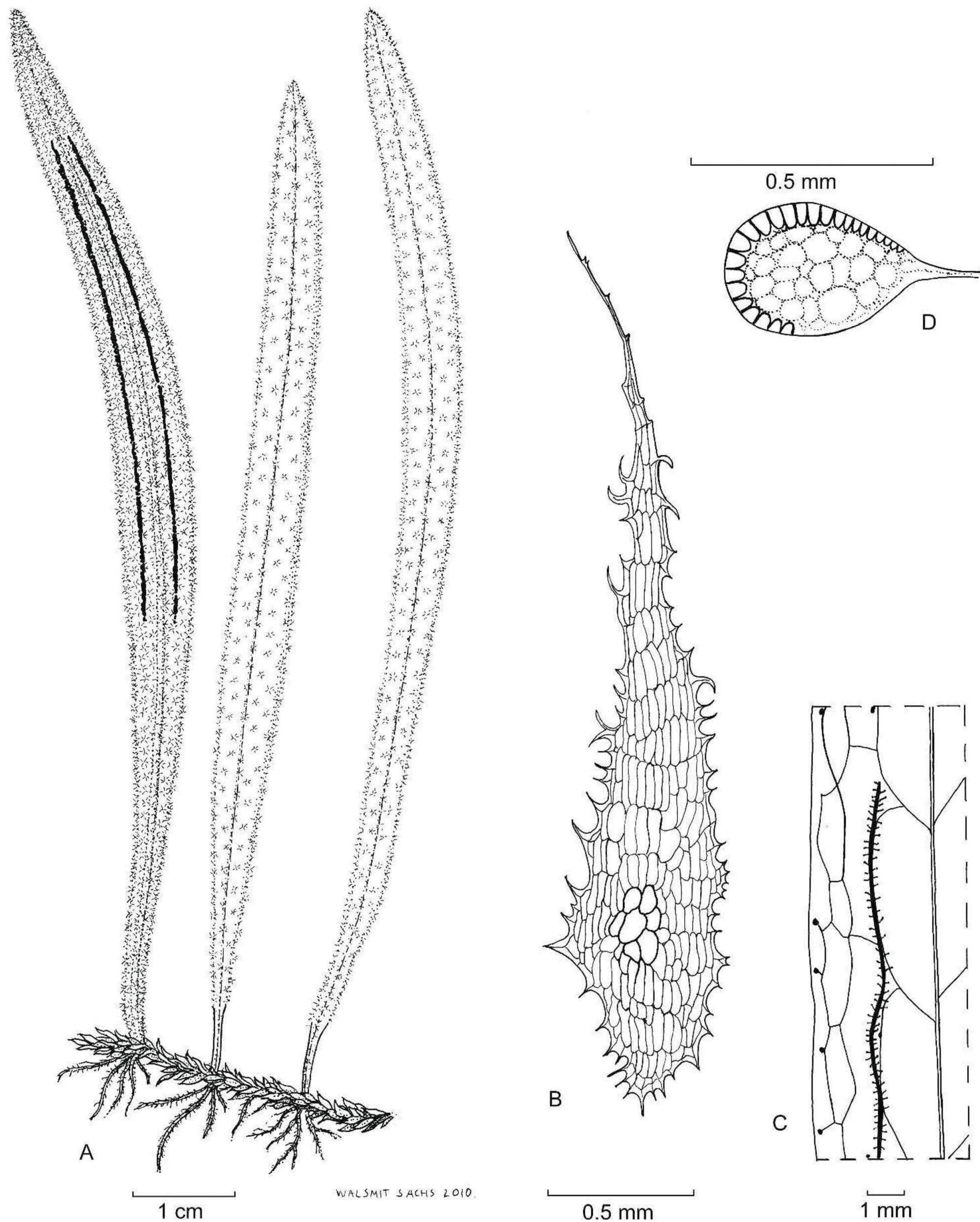


Figure 1. *Pyrrhosia avaratra* Rakotondr. & Hovenkamp. —A. Habit. —B. Rhizome scale. —C. Venation with elongated soral receptacle. —D. Sporangium. Drawing by A. Walsmit Sachs, from *Nusbaumer et al.* 2429 (L).

IUCN Red List category. *Pyrrhosia avaratra* occurs in two locations that are 110 km apart, resulting in an extent of occurrence of 2200 km². It is known from three subpopulations, with the number of individuals in each currently unknown. The area of occupancy can be estimated as 160–170 km². All subpopulations are located within protected areas, but the forests in which they occur are fragmented and threatened by anthropogenic pressures such as fire and grazing. Based on these data, we consider an

assessment of Endangered (EN) as justified (IUCN, 2001).

Etymology. The epithet *avaratra* means “north” in the Malagasy language.

Discussion. *Pyrrhosia avaratra* shares most characters with *P. rhodesiana* (C. Chr.) Schelpe, e.g., the shortly elongated, unsclerified rhizome, the peltate, dentate scales, the monomorphic leaves without a distinct stipe, the dimorphic indument, and the

sparsely verrucate spores. The new species is distinctly different in the narrowed lamina with coenosori and the associated simplification of the venation.

The presence of longitudinal coenosori in a species apparently unrelated to either *Pyrrosia niphoboloides* [≡ *Drymoglossum niphoboloides* Baker] or *P. angustissima* (Giesenh. ex Diels) Tagawa & K. Iwats. [≡ *Saxiglossum angustissimum* (Giesenh. ex Diels) Ching] once more confirms that this character is variable within the genus and provides no basis to distinguish separate genera.

In the key to *Pyrrosia* (Hovenkamp, 1986), *P. avaratra* would key out at couplet 8, which should be modified as follows:

- 8a. Paraphyses absent or inconspicuous, included free veins rare or recurrent 8.5
- 8b. Paraphyses abundant, free veins many, excurrent 11
- 8.5a. Fronds monomorphic *P. avaratra*
- 8.5b. Fronds dimorphic, often distinctly succulent 9

The four species of *Pyrrosia* occurring in Madagascar can be distinguished as follows:

- 1a. Leaves distinctly dimorphic, fertile and sterile fronds usually both present, clearly different; sori marginal; rhizome scales with cilia that are often longer than the width of the scale ... *P. niphoboloides*
- 1b. Leaves monomorphic, the fertile ones similar to the sterile (if present); sori on the lamina; rhizome scales dentate or ciliate with cilia shorter than the width of the scale 2
 - 2a. Sori forming a single longitudinal coenosorus between midrib and margin *P. avaratra*
 - 2b. Sori round or elliptic, but always in several rows between midrib and margin 3
 - 3a. Sori on the apical part of the lamina, with a central tuft of stellate paraphyses; stellate hairs on the lamina apressed, with flattened rays ... *P. lanceolata* (L.) Farw.

- 3b. Sori spread over the entire surface of the lamina, without a central tuft of stellate paraphyses; stellate hairs on the lamina with long, spreading, narrowly cylindrical rays *P. rhodesiana* (C. Chr.) Schelpe

Paratypes. MADAGASCAR. **Antsiranana:** parc nat. de la Montagne d'Ambre, environ 4 km OSO du gîte d'étape, S. T. Malcomber & S. Rapanarivo 1198 (MO, P); sous préfet. Vohémar, commun. Daraina, L. Nusbaumer & P. Ranirison 1332 (G, P); Montagne d'Ambre, versant O, L. Nusbaumer, L. Gautier, P. Ranirison, S. M. Trigui, M. H. Razanajatovo & S. D. Ramandimbimanana 2429 (G, L, P), L. Nusbaumer, L. Gautier, P. Ranirison 2489 (G, P); parc nat. de la Montagne d'Ambre, SO de la station des Roussettes, forêt d'Ampamelonabe, F. Rakotondrainibe 1620 (P); Montagne d'Ambre, versant O, F. Rakotondrainibe 1774 (P); Vohémar, Daraina, forêt de Binara, F. Rakotondrainibe & H. Rasolohery 6450 (L, P, TAN).

Acknowledgments. We thank the curators of herbaria G, MO, and TAN for providing us with electronic photographs of specimens deposited at their institutions.

Literature Cited

Hovenkamp, P. H. 1986. A monograph of the fern genus *Pyrrosia*. Leiden Bot. Ser. 9.
 IUCN. 2001. IUCN Red List Categories and Criteria, Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.
 Schneider, H., A. R. Smith, R. Cranfill, T. J. Hildebrand, C. H. Haufler & T. A. Ranker. 2004. Unraveling the phylogeny of polygrammoid ferns (Polypodiaceae and Grammitidaceae): Exploring aspects of the diversification of epiphytic plants. *Molec. Phylogenet. Evol.* 31: 1041–1063.
 Shing, K. H. & K. Iwatsuki. 1997. On the fern genus *Pyrrosia* Mirbel (Polypodiaceae) in Asia and adjacent Oceania. *J. Jap. Bot.* 72: 19–35.